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(54) SAFETY VALVE TESTING APPARATUS

(71) We, UNITED KINGDOM ATOMIC ENERGY AUTHORITY, LONDON, a British Authority, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to methods of testing safety valves fitted to pressure vessels for protective purposes. As will be known it is necessary to test the correct operation of such safety valves when so fitted in order to ensure that should the pressure within the container rise above a predetermined value the valve opens automatically to provide immediate and adequate venting of the container through the valve. The invention also relates to apparatus for facilitating such tests.

According to the present invention a method of testing a safety valve fitted to a pressure vessel for protective purposes resides in temporarily applying a restraint to the valve to prevent it from opening whilst raising the internal pressure of the vessel to a predetermined value corresponding to at least the operating pressure of the valve removing the restraint when that value is reached and measuring any resulting valve travel.

Testing apparatus for carrying out the method as aforesaid comprises, according to the invention, a restraint means detachably connectable to a safety valve fitted to a pressure vessel, said restraint means effectively restraining opening of the safety valve, means for disabling the effect of the restraint means whilst said restraint means is connected to the safety valve, and means for indicating any subsequent valve travel.

Preferably restraint is applied to the valve through a collapsible link which is capable of transmitting a load to keep the valve closed whilst the vessel is being raised to said pressure and means controllable remotely are provided for collapsing said link so removing the restraint on the valve. Said remotely controlled means may be electrically, hydraulically or pneumatically operable, the pressure fluid for which may be

derived from the interior of the pressure vessel to which the valve is fitted. Alternatively or additionally an independent source of pressure fluid may be provided. The remotely controlled means may be electrically operated from mains or a battery acting through a solenoid.

Apparatus for and a method of applying the invention in one embodiment of the invention to a safety valve having a vertically upwards movement to effect pressure relief of the vessel to which it is fitted will now be described by way of example with reference to the drawing accompanying the Provisional Specification. In the drawing a pressure vessel 1 has fitted the usual safety valve 2 designed to remain closed sealing the pressure vessel interior under normal usage at design pressure but to lift under a predetermined higher pressure to vent the vessel interior to a vent pipe 3 via a branch pipe 4. The test therefore to be made is to ensure that the valve lift occurs at the correct pressure promptly and to its required extent of travel so ensuring adequate venting.

For test purposes the exterior portion of valve 2 is fitted with a detachable assembly including a cylindrical casing 5 having at its open lower end a flange 5a bolted to a prepared flange 6 on the valve casing. The side wall of the casing 5 has a large aperture 7 providing access to its interior. Within the casing the upper part of the valve spindle 8 protrudes through a centralising spider 9 and is pivotally coupled at its upper end to a collapsible bar in the form of three robust toggle links 11, of the latter, the lowermost is pivotally coupled to the spindle and the uppermost link is coupled, again pivotally, to a lever arm 12. The latter is fulcrumed at one end at 13 on a lug inside the casing and protrudes with clearance through a hole 14. At its free end the arm 12 has provision for the attachment of weights 15 of selected values which act through the lever arm to apply a downward pressure through the collapsible bar to the valve stem. It will be clear that by applying weights to the appropriate value to the arm a downward load can be applied to the safety valve sufficient to main-

tain it positively closed at vessel pressures up to and above the working pressure of the valve.

A ring 10 on the valve stem carries a stylus 16 which is adapted to move over recording surface 18 which is upstanding from a bracket 19 spanning the aperture 7. Movement of the valve stem is thus indicated on the recording surface.

Means for disabling the load transmission facility of the collapsible bar are provided in the form of a rod 20 slidably mounted through a sleeved hole 21 in the upper part of the casing 5 adjacent the centre link of the toggle. The rod 20 is operated by a pneumatic cylinder 22, the rod being attached to a piston within the cylinder and movable by compressed air supplied by line 23 under remote control.

To carry out the testing method, the vessel 1 will as is usual be separated from the operators by a partition wall 24 and having loaded the arm 12 with the appropriate counterweight to hold the safety valve closed the vessel filled with gas via a line 25 until a gauge situated behind wall 24 indicates that the pressure within the vessel is equal to that at which venting through the safety valve should occur. At this point, the load on the safety valve is removed suddenly by operating the pneumatic control so as to extend the rod into the casing 5 to strike the pivoted toggle link. The toggle links collapse and so the restraint on the safety valve removed. In lifting, the travel of the valve is recorded on the surface 18 by the stylus 16. A record of valve travel is thus obtained and failure of the valve to open fully is detectable.

If desired, the actuation of the pneumatic control to operate the toggle links may be performed by using the fluid contents of the vessel as the pressure fluid. In this case the cylinder is connected by pipes to the tapping

from the vessel whose internal pressure can be read from the operation room. When the design pressure is reached then a valve is operated to interconnect the vessel interior with the piston which throws the toggle as before.

WHAT WE CLAIM IS:—

1. A method of testing a safety valve fitted to a pressure vessel for protective purposes which resides in temporarily applying a restraint to the valve to prevent it from opening whilst raising the internal pressure of the vessel to a predetermined value corresponding to at least the operating pressure of the valve, removing the restraint when that value is reached and measuring any resultant valve travel.

2. Testing apparatus for carrying out the method claimed in claim 1 comprising a restraint means detachably connectable to a safety valve fitted to a pressure vessel, said restraint means effectively restraining opening of the safety valve, means for disabling the effect of said restraint means whilst said restraint means is connected to said safety valve, and means for indicating any subsequent valve travel.

3. Testing apparatus as claimed in claim 2 in which said restraint means comprises means applying a load to the valve through a collapsible link and a remotely operable means adapted to collapse said link whereby the effect of the restraint means is disabled.

4. A method of testing safety valves substantially as herein described.

5. A testing apparatus for safety valves substantially as herein described with reference to the drawing accompanying the Provisional Specification.

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